

A review of *Amblyotrypauchen* (Teleostei: Gobiidae), a genus of blind amblyopine gobies

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Abstract.—The Indo-West Pacific gobiid genus *Amblyotrypauchen* Hora is reviewed and defined. *Amblyotrypauchen* is unique within the Amblyopinae in having 10+19 vertebrae, enlarged fang-like teeth in both jaws, partially separate pelvic fins, and scale patches on the opercle, cheeks, and dorsum of head. In contrast to most other members of the subfamily, *Amblyotrypauchen* lacks eyes and has been collected off muddy bottoms from almost 17 m to over 183 m in depth. Karsten Murdy is the only other known amblyopine goby that is blind and found at such depths. *Amblyotrypauchen* comprises a single species, *A. arctocephalus*, known from India, Malaysia, Hong Kong, the Philippines, Papua New Guinea, and Australia. A figure of *A. arctocephalus* is provided. *Amblyotrypauchen* is most similar to *Ctenotrypauchen*, *Karsten*, *Trypauchen*, and *Trypauchenichthys*; the five genera are compared.

The subfamily Amblyopinae comprises approximately 15 genera and about 25–30 valid goby species. Amblyopine gobies have a continuous dorsal fin and eel-like bodies. The subfamily is typically associated with muddy substrates in shallow waters (a few centimeters to a few meters) in the Indo-Pacific region. The amblyopine goby *Amblyopus arctocephalus* was described by Alcock (1890) from specimens trawled off the east coast of India at depths from 37 m to 92 m over muddy substrate. Alcock did not compare his new species to any other goby but did mention that: (1) the head lacked scales and was compressed into a sharp ridge; (2) the eyes were “hidden”; and (3) the jaws contained large canine teeth. A figure was also provided. Almost 35 years later, Hora (1924) described *Amblyotrypauchen fraseri* as a new genus and species of eel-like goby. Hora based his description on a single specimen trawled off the east coast of India at a depth of 37 m over a mud bottom. Hora (1924) stated that the unique features of his new taxon were “well-marked” canine teeth and relatively large pelvic fins. He also stated that the

head of *Amblyotrypauchen* had scales and that the eyes “were not visible but their position is indicated by orbital depressions.” A figure of *Amblyotrypauchen fraseri* was provided, which is reproduced here as Fig. 1. Hora (1924) made no reference to *Amblyopus arctocephalus* Alcock.

After examining type material of both *Amblyopus arctocephalus* and *Amblyotrypauchen fraseri* at the Indian Museum (now the Zoological Survey of India), Koumans (1941) synonymized the latter species with the former but retained the genus *Amblyotrypauchen* for *arctocephalus*. In his descriptive account of *Amblyotrypauchen*, Koumans (1941) stated that the eyes were “small.” However, in his species account of *A. arctocephalus* that immediately followed the genus account, Koumans stated that the eyes were “hidden.” In addition to specimens collected off the east coast of India, Koumans (1941) mentioned that he examined specimens of *A. arctocephalus* at the Indian Museum from the Arabian Sea and the Gulf of Martaban (Myanmar). The only other published record of *A. arctocephalus* that I can locate is that of Herre and

Herald (1951) who reported on *A. arctocephalus* collected by trawl from 35–53 m in Manila Bay, Philippines. Although not having any specimens at hand, Smith (1959) opined that *A. arctocephalus* would eventually be found in the western Indian Ocean.

None of the published accounts definitively state that *A. arctocephalus* lacks eyes. In addition, none remarks on the relative deep-dwelling habits of this species as compared to other amblyopine gobies. As such, the objectives of this study were to: (1) re-describe *Amblyotrypauchen*, (2) define *Amblyotrypauchen* using putative derived characters, (3) to provide characters for differentiating *Amblyotrypauchen* from other amblyopines, and (4) to provide and analyze distributional and ecological data.

Materials and Methods

All measurements are straight-line distances made with dial calipers and recorded to the nearest 0.1 millimeter. All fish lengths given are standard lengths (SL) except where noted as total length (TL). Methods of measurements and counts follow Murdy (1989), and Murdy and Shibukawa (2001).

The vertebral count is separated into precaudal and caudal counts, the latter including the urostylar complex; caudal vertebrae possess a distinct hemal spine that is lacking in precaudal vertebrae. Counts of axial skeletal features (i.e., vertebrae, pleural and epineural ribs, pterygiophores, and epurals) were taken from radiographs and cleared and stained material. The methods of Birdsong et al. (1988) were used in describing the relationship between the spinous dorsal-fin pterygiophores and the underlying vertebrae.

Institutional abbreviations are as listed in Leviton et al. (1985). All specimens examined are listed in the material examined section and grouped by major geographic areas. The total number of specimens examined and size range follow each catalog

number. Depth of capture is provided when known.

Systematic Account

Amblyotrypauchen Hora, 1924

Amblyotrypauchen Hora, 1924:160 (type species, *Amblyotrypauchen fraseri* Hora 1924 = *Amblyopus arctocephalus* Alcock, 1890)

Included species.—*Amblyotrypauchen* comprises a single species, *A. arctocephalus* (Alcock, 1890).

Diagnosis.—A genus of Amblyopinae with prominent canine teeth in both jaws; head, cheek and opercle with scale patches; and, typically, 19 caudal vertebrae. Pelvic fins with innermost rays joined for one-third to one-half their length.

Osteology.—Spinous dorsal-fin pterygiophore formula typically 3-1221, one specimen with 3-123. Precaudal vertebrae typically 10, caudal vertebrae typically 19, one specimen with 9+23. Pterygiophore of the second soft dorsal-fin ray (posteriormost pterygiophore inserting in 7th interneural space) lacking a middle radial. Typically three anal-fin pterygiophores anterior to first hemal spine, one specimen with four. Epurals 2. Basihyal spatulate. Symplectic lacking a posteriorly directed arm cartilaginously joining the hyomandibular, consequently, no gap present between dorsal aspect of symplectic and the hyomandibular. Frontal crest prominent, without serrated edge. Atlas with well-developed parapophyses, in contact with first epineural rib. Epineurals present from 1st precaudal vertebra to 14th caudal vertebra. Well-developed pleural ribs on 3rd to 9th precaudal vertebrae.

Amblyotrypauchen arctocephalus (Alcock, 1890)

(Figs. 1–2, Tables 1–2)

Amblyopus arctocephalus Alcock, 1890: 432 (type locality, off Orissa and Vizagapatam, India)

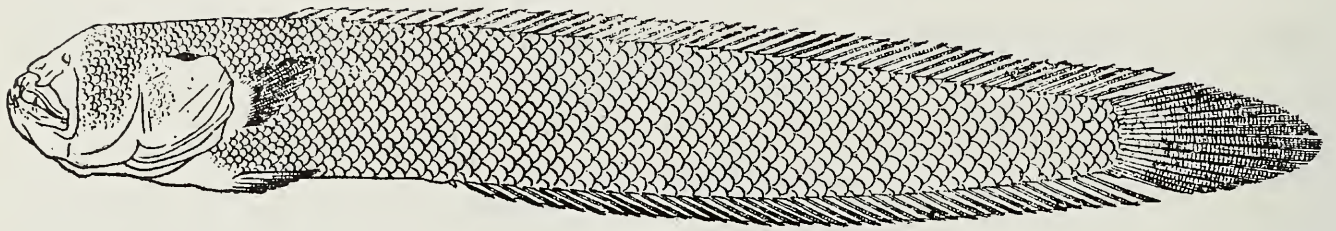


Fig. 1. *Amblyotrypauchen fraseri* (=arctocephalus) from Hora (1924). Note that a shallow cavity exists in the area typically occupied by an eye. The figure depicts the dorsal and anal fins not connected with the caudal fin, and a fully scaled cheek. This is in contrast to other published accounts and specimens examined in this study in which the dorsal and anal fins are confluent with the caudal fin, and the cheek is much less densely scaled.

Amblyotrypauchen fraseri Hora, 1924:160, fig. 4a (type locality, off the mouth of the Hugli River, India)

Amblyotrypauchen arctocephalus: Koumans, 1941, new combination

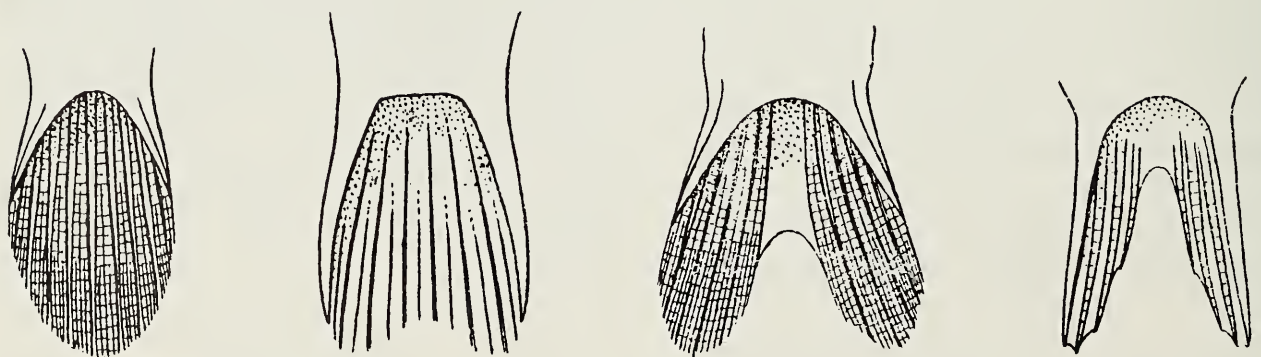
Material examined.—(18 specimens from 10 localities; size range 36.1–137.6 mm). Malaysia, Strait of Malacca: USNM 296958, depth 101 m, 3:47.9–118.2 mm. Hong Kong: AMS I.18552-001, depth 16–18 m, 1:115.1 mm. Philippines, Lingayan Gulf: USNM 151242, depth 82 m, 1:116.1 mm; USNM 113200, 1:125.3 mm. Manila Bay: CAS 53856, 2:120.2–125.7 mm. Western Samar: USNM 113202, depth 37 m, 2:110.1–122.7 mm; USNM 113197, depth 48 m, 3:115.3–129.0 mm. Negros: USNM 151432, depth 176 m, 1:39.1 mm. Cebu: 113238, 1:137.6 mm. Davao: 113198, depth 183 m, 1:36.1 mm. Papua New Guinea, mouth of Rama River: AMS

I.16753-024, 1:98.0 mm. Australia, Arafura Sea, AMS I.19289-005, depth 55 m, 1:72.8 mm.

Diagnosis.—As for genus.

Description.—Proportional measurements given in Table 1. The following description of counts (Table 2) is based on radiographs, and one cleared and stained specimen removed from USNM 113197.

Total dorsal-fin elements 48–52; first dorsal fin with six flexible spines; first element of second dorsal fin segmented, branched or unbranched, all others segmented and unbranched, all others segmented and branched rays; dorsal-fin base long and broadly joined with caudal fin. Total anal-fin elements 39–43, first element segmented and unbranched, all other elements segmented and branched; anal-fin height less than second dorsal-fin height; anal-fin membrane broadly joined with caudal fin. Pectoral fin with 14–18 rays, crescent-



Trypauchen

Ctenotrypauchen

Amblyotrypauchen

Trypauchenichthys

Fig. 2. Pelvic fin shapes of *Trypauchen*, *Ctenotrypauchen*, *Amblyotrypauchen*, and *Trypauchenichthys*, from Hora (1924). The pelvic fins of large specimens (>120 mm) of *Amblyotrypauchen* can have the pelvic fins more deeply incised than shown in the figure.

Table 1.—Proportional measurements of *Amblyotrypauchen arctocephalus*.

	n	Mean	Range
Standard length/TL	6	0.845	0.833–0.858
Head length/SL	11	0.201	0.179–0.214
Pelvic-fin length (PEL)/SL	11	0.085	0.062–0.111
Pelvic-fin length/HL	11	0.421	0.320–0.550
Pectoral-fin length/SL	19	0.064	0.042–0.098
Pectoral-fin length/HL	19	0.314	0.206–0.457
Pectoral-fin length/PEL	19	0.764	0.431–1.137
Head width/SL	11	0.094	0.025–0.113
Snout length/SL	11	0.058	0.041–0.115
Jaw length/SL	11	0.068	0.056–0.076
Interorbital width/SL	11	0.031	0.023–0.039
Nape width/SL	11	0.074	0.065–0.083
Body depth/SL	11	0.141	0.124–0.152
Predorsal length/SL	11	0.241	0.183–0.261
Prepelvic length/SL	11	0.192	0.174–0.205
Preanal length/SL	11	0.406	0.370–0.433

shaped with dorsal rays longer than ventral ones; all pectoral-fin rays segmented, some of the longer rays are branched distally. Pelvic-fin rays I, 5; frenum present; basal membrane uniting fins present for approximately one-third to one-half the length of innermost rays; smaller specimens typically have less deeply divided pelvic fins than larger specimens. Caudal fin with 17 segmented rays including 8+7 branched rays and a dorsal and ventral simple ray; unsegmented procurrent rays 4, dorsally and ventrally.

Scales cycloid, present on entire body with scale patches on head, cheek, and opercle, largest scales near caudal-fin base. Scales on head, cheek, and opercle present in patches of as few as two or three to as many as nine or 10 scales, the largest scale patch often posterior to the orbit. Scales on body extending from areas dorsal and ven-

tral to opercle posteriorly to caudal-fin base. Longitudinal scale count 60–77, scales difficult to count with accuracy.

Typically, two lateral rows of teeth in each jaw, more than two rows anteriorly; outer-row teeth much larger and more pointed than those of inner rows; lower-jaw teeth longer than upper-jaw teeth; 2–5 fang-like teeth in outer row of upper jaw, typically interlocking with those of lower jaw; numerous conical teeth in inner row(s) of upper jaw; 4–7 fang-like teeth in outer row of lower jaw; numerous conical teeth in inner row(s) of lower jaw. No palatine or vomerine teeth present. No sexual dimorphism with respect to teeth.

Tongue thick, tip rounded, free from floor of mouth. Gape wide, mouth oblique (about 45°); maxilla extending posteriorly to vertical below anterior half of orbit; posteriorly, near tip of maxilla, upper lip ex-

Table 2.—Selected counts of *Amblyotrypauchen arctocephalus*.

Character	n	Mean	Frequencies
Dorsal-fin rays (total elements)	13	49.7	48(1), 49(6), 50(4), 52(2)
Anal-fin rays (total elements)	13	40.1	39(4), 40(6), 41(2), 43(1)
Pectoral-fin rays	21	16.2	14(2), 15(5), 16(5), 17(5), 18(4)
Longitudinal scale rows	16	69.5	60(3), 67(2), 68(1), 70(3), 71(1), 72(1), 74(2), 76(2), 77(1)
Upper jaw teeth (outer row)	10	3.6	2(2), 3(1), 4(6), 5(1)
Lower jaw teeth (outer row)	10	4.5	4(7), 5(2), 7(1)

panded into large fold that joins similar fold of lower lip at rictus, fold completely covering posterior part of jaws even when agape. No barbels on underside of head.

Eye absent. Posterior naris large and located in cavity where eye normally would be located; anterior naris at tip of small tube-like flap that slightly overhangs upper jaw.

Cephalic sensory canals and pores absent. Head papillae numerous, found on dorsum, cheek, opercle, and along lower jaw line. Papillae grouped in short series (<1 mm) that appear as whitish lines.

Shallow pouch present along the dorsal edge of the operculum. Gill rakers very short, pyramidal-shaped, and not ossified; six or fewer on lower limb of first gill arch. Gill opening narrow, extending only the length of pectoral-fin base or slightly more ventrally.

Genital papilla large and bulbous in females, bilobed in gravid specimens. Male papilla fleshy and triangular with distinct tip.

Coloration.—No fresh specimens were available for this study. Based on Alcock's original description, this species is mottled pink with hyaline fins. In preserved material, dorsum of head and body dark brown to gray, remainder of head and body uniformly pale or pale brown; no spots or stripes on body or fins; fins translucent; fang-like teeth on outer rows of both jaws often reddish brown in larger specimens.

Distribution.—Northeast coast of India eastward to Hong Kong and the Philippines, southward to Papua New Guinea and off the north coast of Australia. Reports of specimens from the Arabian Sea and Gulf of Martaban (Myanmar) by Koumans (1941) are unconfirmed.

Ecology.—This species inhabits muddy bottoms from almost 17 m to over 183 m in depth; for both amblyopines and gobies in general, these are uncharacteristic depths. None of the material examined was collected in typical amblyopine habitats, which are shallow, mud-bottomed areas near river

mouths. The type material of *Amblyopus arctocephalus* Alcock (1890) was collected from 37–92 m, whereas the type of *Amblyotrypauchen fraseri* was collected from about 37 m (Hora 1924). The fang-like teeth suggest that this species is carnivorous, and a radiograph of one specimen (AMS I.16753-024) revealed the presence of an elongate fish in the stomach.

Remarks.—The genus *Amblyopus* (Valenciennes in Cuvier & Valenciennes, 1837: 157) is regarded as an unneeded substitute for *Taenioides* Lacepède (1800) and is thus considered an objective synonym of *Taenioides* (Eschmeyer, 1998). *Taenioides* is diagnosed among Gobiidae by its possession of a Y-shaped, second anal-fin pterygiophore (Birdsong et al. 1988); *Amblyotrypauchen* lacks this feature.

After examining the types of both species, Koumans (1941) synonymized *A. fraseri* with *A. arctocephalus*. Similar judgments were rendered by Smith (1959) and Menon and Yazdani (1968). Although wanting to examine the types of *A. arctocephalus* and *A. fraseri*, or at least obtain radiographs of them, I was unable to do so. I also was unable to determine the current status of Alcock's and Hora's types at the Zoological Survey of India. Regardless, there appears to be little reason to dispute the synonymy of *A. fraseri* with *A. arctocephalus* based on comparison of the original descriptions. When Hora (1924) described his new genus and species, he made no mention of Alcock's species, which had been collected in the same general vicinity as Hora's species (NW corner of the Bay of Bengal); I assume Hora was unaware of the existence of Alcock's description.

Two items in Alcock (1890) need mention. First, Alcock described a "short broad barbel" on each side of the upper jaw; this structure is a narial tube rather than a barbel. Secondly, Alcock stated that *A. arctocephalus* possesses 11 abdominal and 17 caudal vertebrae. Whereas it is possible that Alcock was not mistaken, in this study, I radiographed 13 specimens and all but one

have 10 precaudal and 19 caudal vertebrae. The atypical specimen has 9 precaudal and 23 caudal vertebrae.

Several items in Hora (1924) also require discussion. First, Hora stated the dorsal-fin ray count of his single specimen as "7/40." Fin rays of amblyopines are very difficult to count without radiography. As none of the radiographed specimens in this study possess seven dorsal-fin spines, I assume Hora's count was in error. Second, Hora mentioned in the text that the dorsal and anal fins were "separated from the caudal by a short distance." However, Alcock (1890) stated that in his specimens, the dorsal and anal fins were confluent with the caudal fin; Koumans (1941) made a similar statement about the specimens he examined. In amblyopines, the membrane uniting the dorsal and anal fins with the caudal fins is thin and easily torn in handling. Some of the specimens examined in this study had torn membranes, and I assume that this also occurred to Hora's specimen. Lastly, Hora's figure of *A. fraseri* (reproduced here as Fig. 1) not only depicts the dorsal and anal fins not connected with the caudal fin, but also shows a cheek more fully scaled than on any specimen examined in this study. Possibly head scales slough off over time or with frequent handling such that older preserved material, like that examined in this study, does not accurately reflect the degree of head scalation found in fresher specimens. Alcock (1890) mentioned that the head was naked in his specimens and Koumans (1941) described the specimens he examined as having "some scales on head behind eye and on cheek and opercle." The degree of scalation of the head of *A. arctocephalus* can probably only be adequately assessed by examining fresh material.

Comparison of Amblyotrypauchen with other 'Trypauchen' group members.—Based on their shared absence of an interneural gap, Birdsong et al. (1988) created the monophyletic unit called the 'Trypauchen' group that comprised *Amblyotrypauchen*, *Caragobius*, *Trypauchen*, and *Try-*

pauchenichthys. Murdy (2002) added *Ctenotrypauchen* and a new genus (*Karsten*) to the 'Trypauchen' group and provided a key to the 'Trypauchen' group genera. *Caragobius* and *Karsten* lack an opercular pouch whereas the other 'Trypauchen' group genera have one. Hora (1924) distinguished *Amblyotrypauchen* from *Ctenotrypauchen*, *Trypauchen*, and *Trypauchenichthys* by its possession of canine teeth, as well as by the shape of the pelvic fins (Fig. 2). As a result of this investigation, I can further differentiate *Amblyotrypauchen* from these three genera by its possession of head scales (lacking in the other genera) and 10+19 vertebrae (all other genera typically have 20 or more caudal vertebrae). Murdy (2002) compared *Amblyotrypauchen* to *Karsten*, the only other blind amblyopine. *Karsten* differs from *Amblyotrypauchen* in having a typical spinous dorsal-fin pterygiophore formula of 3-123 or 3-132 (vs. 3-1221 in *Amblyotrypauchen*), possessing nine precaudal vertebrae (vs. 10 in *Amblyotrypauchen*), degree of scalation (scaled only posteriorly in *Karsten* vs. scaled on entire body including scale patches on the head in *Amblyotrypauchen*), in presence/absence of an opercular pouch (absent in *Karsten* vs. present in *Amblyotrypauchen*), and tooth size (slightly enlarged teeth in outer row of jaws vs. very large and fang-like in *Amblyotrypauchen*).

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Literature Cited

- Alcock, A. W. 1890. Natural history notes from H. M. Indian marine survey steamer *Investigator*. Commander R. F. Hoskyn, R. N., commanding.—No. 20. On some undescribed shore-fishes from the Bay of Bengal.—*Annals and Magazine of Natural History* 6: 425–443.

- Birdsong, R. S., E. O. Murdy, & F. L. Pezold. 1988. A study of the vertebral column and median fin osteology in gobioid fishes with comments on gobioid relationships.—*Bulletin of Marine Science* 42:174–214.
- Cuvier, G., & A. Valenciennes. 1837. *Histoire naturelle des poissons*. Tome douzième. Suite du livre quatorzième. Gobioides. Livre quinzième. Acanthoptérygiens à pectorales pédiculées. Chez F. G. Lerrault, Paris, 507 pp.
- Eschmeyer, W. N. (ed.). 1998. *Catalog of fishes*. Special publication No. 1 of the Center for Biodiversity Research and Information.—*California Academy of Sciences* 1–3:1–2905.
- Herre, A. W. C. T., & E. S. Herald. 1951. Noteworthy additions to the Philippine fish fauna with descriptions of a new genus and species.—*Philippine Journal of Science* 79:309–340.
- Hora, S. L. 1924. Notes on fishes in the Indian Museum. VI. On a new genus of gobioid fishes (subfamily Trypaucheninae) with notes on related forms.—*Records of the Indian Museum* 26:155–163.
- Koumans, F. P. 1941. Gobioid fishes of India.—*Memoirs of the Indian Museum* 13:205–329.
- Lacepède, B. G. E. 1800. *Histoire naturelle des poissons*, vol. 2. Chez Plassan, Paris, 632 pp.
- Leviton, A. E., R. H. Gibbs, Jr., E. Heal, & C. E. Dawson. 1985. Standards in herpetology and ichthyology, part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology.—*Copeia* 1985:802–832.
- Menon, A. G. K., & G. M. Yazdani. 1968. Catalogue of type-specimens in the Zoological Survey of India, part 2.—Fishes.—*Records of the Zoological Survey of India*, 61 (pts 1–2) [1963]:91–190. [Not published until 1968.]
- Murdy, E. O. 2002. *Karsten*, a new genus of eel goby (Gobiidae: Amblyopinae) with a key to 'Trypauchen' group genera.—*Copeia* 2002(3):787–791.
- , & K. Shibukawa. 2001. A revision of the gobiid fish genus *Odontamblyopus* (Gobiidae: Amblyopinae).—*Ichthyological Research*, 48(2001)1:31–43.
- Smith, J. L. B. 1959. Gobioid fishes of the families Gobiidae, Periophthalmidae, Trypauchenidae, Taenioididae and Kraemeriidae of the western Indian Ocean.—*Rhodes University, Department of Ichthyology, Ichthyological Bulletin*, 13: 185–225, pls. 9–13.